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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/735,926	12/16/2003	Masatoshi Shiraishi	OMY-0034	4251

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EXAMINER	
CHACKO DAVIS, DABORAH	

ART UNIT	PAPER NUMBER
1756	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/735,926	SHIRAISHI ET AL.	
	Examiner	Art Unit	
	Daborah Chacko-Davis	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 July 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-30* is/are pending in the application.

4a) Of the above claim(s) *1-21* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *22-30* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claim 22 is rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over U. S. Patent No. 5,626,913 (Tomoeda et al., hereinafter referred to as Tomoeda).

Tomoeda, in col 5, lines 65-67, in col 6,lines 1-8, and lines 28-62, in col 7, lines 1-8, in col 8, lines 47-67, discloses a wafer processing system (substrate processing apparatus) that includes resist coating units (resist film forming means) that coat a resist on the surface of a wafer (form a resist film), and a controller (mass-flow controller and a flowmeter) that controls the supply amount (distribution of a dissolving characteristic of the resist) of the developing solution introduced onto the surface of the resist film on the wafer so as to develop the resist film avoiding development non-uniformity (i.e., developing the resist in a direction of a thickness of the resist film), wherein the developing solution is controlled via the mass-flow controller prior to developing the substrate (substrate coated with the resist). (claim 22).

Tomoeda teaches a developing unit that is controlled by a mass-flow controller and a flowmeter. In the event any differences can be shown for the developing unit that controls the developing solution in a direction of a thickness of the resist film, as

opposed to the mass-flow controlled developing unit taught by Tomoeda, such differences would have been obvious to one of ordinary skill in the art because Tomoeda, in col 7, lines 1-8, in col 8, lines 13-15, lines 16-31, in col 9,lines 1-13, teaches that the developing solution supply is controlled in a manner that the i) developing solution supply is gradually increased thereby gradually increasing the concentration of the developing solution, ii) the developing solution supplied spreads more smoothly on the resist film, and iii) that the development process is so performed to avoid any development non-uniformity caused by the resist residual (scum of the resist) dissolved in the developing solution realizing uniform development i.e., the development of the resist is in the direction of the thickness of the resist film.

3. Claim 23, is rejected under 35 U.S.C. 102(b) as being anticipated by U. S. Patent Application Publication No. 2002/0076658 (Matsushita et al., hereinafter referred to as Matsushita).

Matsushita, in [0012], [0013, [0014], [0017], discloses a coating and developing apparatus (substrate processing apparatus) that is capable of transferring a substrate that has a first surface and a second surface opposite to the first surface (see wafer W, in figure 12), to an exposing processing unit (half-exposing a resist i.e., prior to the peripheral exposure performed in the peripheral exposure apparatus, reference 65 of figure 7). Matsushita, in [0036], [0037], [0038], and [0039], discloses that the coating and developing apparatus includes a coating unit that coats the wafer W with a resist solution to form a resist-coating film on the wafer surface (first surface). Matsushita, in [0042], and [0049], discloses that the wafer (resist coated wafer) is set on a heating

plate (temperature adjusting plate) that heats the wafer from the second surface side. Matsushita, in [0082], discloses that the temperature adjusted air (heating portion) is flown down into the temperature adjusting unit i.e., heating provided at the first surface of the resist-coated wafer, and that the temperature adjusted wafer is transferred to an interface section (S2 of figures 3, and 4)) prior to transferring to the exposing apparatus (reference 200 of figure 3), and Matsushita, in [0082], [0087], [0088], and [0096], discloses that the temperature adjusting unit supplies temperature adjusted air, and that a heater is provided at the temperature adjusting unit (to heat), i.e., heat the resist layer, wherein the heating that is performed on its top surface area and its bottom surface area will inherently create in the resist layer, a top cured hardened portion constituting the first layer, a bottom surface area portion of the resist layer (that is hardened due to the heating supplied form the temperature adjusting plate) resulting in a bottom cured hardened portion constituting a second layer, and a less heated mid-portion of the resist layer forming a less cured (i.e., more moisture portion of the resist layer) constituting a third resist layer sandwiched between the first and second layer (claim 23).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claim 24, 26-27, and 30, is rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent Application Publication No. 2002/0076658 (Matsushita et al., hereinafter referred to as Matsushita) in view of U. S. Patent Application Publication No. 2002/0123011 (Kawano et al., hereinafter referred to as Kawano).

Matsushita is discussed in paragraph no. 6.

Matsushita, in [0049], teaches that the heating from the second surface side at a second temperature is provided by a heating plate (second heating plate) on which the wafer is set. Matsushita, in [0082], discloses that air at a different temperature (first temperature, temperature adjusted air) is flown into the first surface side of the wafer i.e., heating provided at the first surface (claim 24).

The difference between the claims and Matsushita is that Matsushita does not disclose that the temperature-adjusted air provided at the first surface is heated by a first heating plate.

Kawano, in [0151], [0152], [0153], [0154], [0156], and in figure 11, discloses providing a first heating plate (proximity plate, reference 1107 of figure 11) that has a first temperature at the first surface side of the resist coated wafer to heat the resist film and a second heating plate that has a second temperature at the second surface of the resist coated wafer. Kawano, in [0156], and [0183], discloses that the first heating plate (proximity plate) is heated to about 100°C, and the second heating plate is heated to about 140°C, and that heating can be performed for about 90 seconds (claims 26-27, and 30).

Therefore, it would be obvious to a skilled artisan to modify Matsushita by employing the proximity plate as the first heating plate to heat the first surface side of the wafer as suggested by Kawano because Kawano, in [0156], [0157], [0158], discloses that using proximity plate as the heating plate (first heating plate) prevent condensation of the evaporated substances from the resist film formed, and thus avoids falling droplets from dissolving the solid resist film on the wafer further preventing degradation of the film thickness distribution.

6. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 6,371,667 (Kitano et al., hereinafter referred to as Kitano) in view of U. S. Patent No. 6,300,043 (Konishi et al., hereinafter referred to as Konishi).

Kitano, in col 1, lines 43-47, in col 3,m lines 60-67, in col 5, lines 11-18, and lines 53-67, in col 6, lines 1-12, discloses a coating and developing apparatus (substrate processing apparatus) that includes a holder for holding the wafer (substrate holder, see figure 4, W is positioned on a holder), a first nozzle N1 (or N11) that coats the substrate with a first resist, and a second nozzle N2 (or N12) that contains a second material different from the first resist material to coat the substrate with a second resist. Kitano, in col 10, lines 61-67, and in col 11, lines 1-12, discloses that the first resist discharge nozzle and the second resist discharge nozzle are moveable in radial direction of the wafer (along the surface of the substrate) by a common drive system (reference 111 of figure 28).

The difference between the claims and Kitano is that Kitano does not disclose

that the second resist solution that forms the second resist film is coated onto the first resist film formed on the wafer, and that the second resist film exposure reacts with a second exposure energy smaller than the first exposure energy required (for reacting) of the first resist.

Konishi, in col 4, lines 48-67, in col 5, lines 53-67, in col 6, lines 28-41, discloses discharging a first resist solution via a nozzle (reference 73) to form a resist film on the substrate, discharging a second coating (acidic film) via a different nozzle for coating a second film on the resist film, wherein the second film is a TARC acidic film and TARC film inherently has a second exposure energy (TARC films have a low index and low absorption requirement) that is less than the exposure energy required by the first resist film, and the TARC film is coated onto the resist film so that upon exposure of the TARC coated resist, the surface reflection of the light used in the exposure is prevented i.e., the second resist and first resist is integrally exposed.

Therefore, it would be obvious to a skilled artisan to modify Kitano by using second nozzle to discharge the second film material onto the first resist material film as suggested by Konishi because Konishi, in col 2, lines 35-44, discloses that the acid component solution formed on the first resist film has a low dissolving power and thus protects the underlying resist layer from dissolving and Konishi, in col 6, lines 28-41, discloses that the acidic solution forms a TARC coating on the resist film and prevents surface reflections of the light used for light exposure, and Kitano, in col 5, lines 53-67, and in col 6, lines 1-11, discloses that the resist solutions from the resist solution tanks that are discharged from the corresponding discharge nozzles are independent of one

another and that the viscosity of the resist solutions are different from one another, i.e., each resist solution has a different exposure energy requirement.

7. Claims 28-29, are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent Application Publication No. 2002/0076658 (Matsushita et al., hereinafter referred to as Matsushita) in view of U. S. Patent Application Publication No. 2001/0003964 (Kitano et al., hereinafter referred to as Kitano '64).

Matsushita is discussed in paragraph no. 3.

The difference between the claims and Matsushita is that Matsushita does not disclose controlling the pressure during the heating of the resist on both the top surface and the bottom surface (claim 28). Matsushita does not disclose that the pressure controlling means controls the pressure to the claimed range from the normal pressure (claim 29).

Kitano, in [0018], [0020], discloses control means that controls the atmosphere in the container, wherein the container houses the resist coated substrate and has heating means to heat the resist. Kitano, in [0081], discloses that the atmosphere in the container is controlled such that the atmospheric pressure is reduced to about 13.3Pa.

Therefore, it would be obvious to a skilled artisan to modify Matsushita by employing the control means to control the pressure as suggested by Kitano because Kitano, in [0012], and [0081], discloses that controlling the pressure in the atmosphere of the container, that houses the resist coated substrate, to a reduced pressure enables the drying of the resist coating applied on the substrate in a short time, and enables the formation of a resist coating film with uniform thickness.

Response to Arguments

8. Applicant's arguments filed July 18, 2007, inregards to claims 22-25, have been fully considered but they are not persuasive. The 102 rejections made over claims 22-23, and 103 rejections made over claims 24-25, in the previous office action (paper no. 20070416) are maintained.

A) Applicants argue that Tomoeda does not disclose the structure of the present invention.

Claim 22 recites a resist film forming means, and controlling means that controls the developing solution application. Tomoeda teaches a resist coating unit and a mass flow controller that controls the developing solution being applied on the resist film.

B) Applicants argue that Tomoeda does not teach the claimed invention as claimed in claim 22, wherein a controlling means controls the dissolving characteristics of the resist against the developing solution in the direction of the thickness of the resist such that a layer easily dissolvable in the developer and a layer uneasily dissolvable in the developing solution is contrastively formed.

Claim 22, recites

resist film forming means for coating a resist on a substrate so as to form a resist film thereon; and

controlling means for controlling a distribution of a dissolving characteristic of the resist against a developing solution used for developing the resist in a direction of a thickness of the resist film prior to developing the substrate to which the resist is coated.

The claim does not recite a resist layer easily dissolvable in the developer and a resist layer uneasily dissolvable in the developing solution being contrastively formed.

However, Tomoeda, in col 5, lines 65-67, in col 6, lines 1-8, in col 16, lines 7-23, discloses that the resist film after exposure to a predetermined pattern is developed to form a resist pattern i.e., portions of the resist layer that is dissolvable due to exposure is developed away, and portions of the resist layer that is not dissolvable (masked portions of a positive resist) remains to form the resist pattern. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., a controlling means controls the dissolving characteristics of the resist against the developing solution in the direction of the thickness of the resist such that a layer easily dissolvable in the developer and a layer uneasily dissolvable in the developing solution is contrastively formed) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

C) Applicants argue that none of the references viz., Matsushita, and Kawano teach a heating portion for heating the resist coated on the first surface of the substrate from the first surface side and the second surface side so that a first layer obtained by baking the resist is formed on a front surface side of the resist, and second layer heated is formed on a rear surface side of the resist, and a third layer containing the moisture is formed between the first layer and the second layer.

Although Kawano teaches heating the first surface side of the resist layer with a proximity heating plate and heating the second surface side of the resist layer with a heating plate, Kawano is not depended upon to disclose this limitation. Matsushita as

discussed in paragraph no. 3, above, discloses heating the resist coated on the substrate on the second surface side using a heating plate, and heating the resist coated substrate in the first surface side using temperature adjusted air from the temperature adjusting unit that employs a heater, and therefore will inherently result in the claimed first top cured layer, a second bottom cured layer and a midportion of the resist layer (third layer) that maintains a certain moisture content, positioned between the first top cured layer and second bottom cured layer.

D) Applicants argue that Konishi does not disclose exposing the second resist laminated on the first resist because the acidic solution does not remain on the resist film at the time of exposure.

Konishi, in col 6, lines 28-45, discloses that the acidic solution of TARC composition is applied on the surface of the resist film to form a TARC coating and is used to prevent surface reflection of the light used during exposure i.e., the resist film along with the TARC acidic film laminate is exposed to light.

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daborah Chacko-Davis whose telephone number is (571) 272-1380. The examiner can normally be reached on M-F 9:30 - 6:00. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark F Huff can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

dcd

September 27, 2007.

MARK F. HUFF
SUPERVISORY PATENT EXAMINER
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